

# ***Incentives and Structures: Building collaborations at Argonne***

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**Argonne National Laboratory**  
Operated by The University of Chicago  
for the U.S. Department of Energy

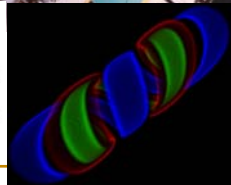
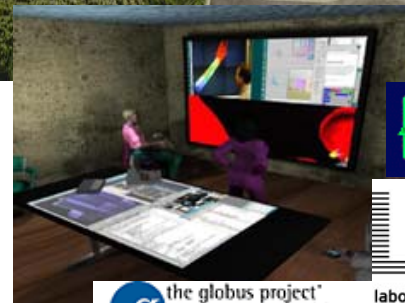
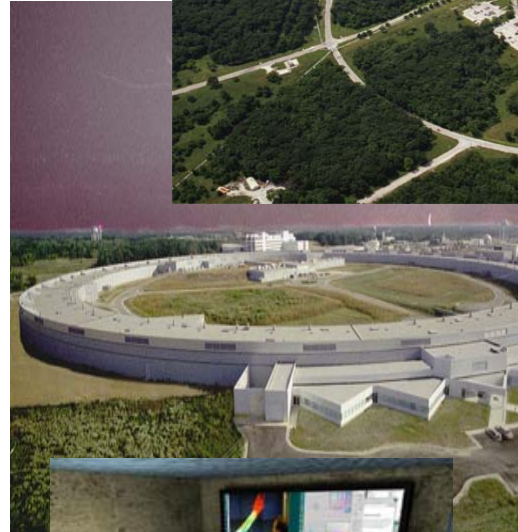




# About Argonne: What is it?

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- ❑ Founded in 1943, designated a national laboratory in 1946
- ❑ Managed by The University of Chicago for the Department of Energy
  - ~ 4000 employees, 4000 facility users
  - ~ \$500M budget
  - 1500-acre site in Illinois
  - 800-acre site in Idaho
- ❑ “Multi-purpose” Lab: Broad R&D portfolio
- ❑ Numerous sponsors: DOE, NIH, ...



# About Argonne: What is being done there?

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## ❑ Basic and applied research

- ❑ Materials and chemical sciences and engineering
- ❑ High energy, nuclear, and atomic physics
- ❑ Multidisciplinary nanoscience and nanotechnology
- ❑ Structural biology, functional genomics, and bioinformatics
- ❑ Environmental science, technology, and assessment
- ❑ Transportation technology
- ❑ Computer science and applied mathematics
- ❑ Computational science



## ❑ Design, construction, and operation of accelerator-based user facilities

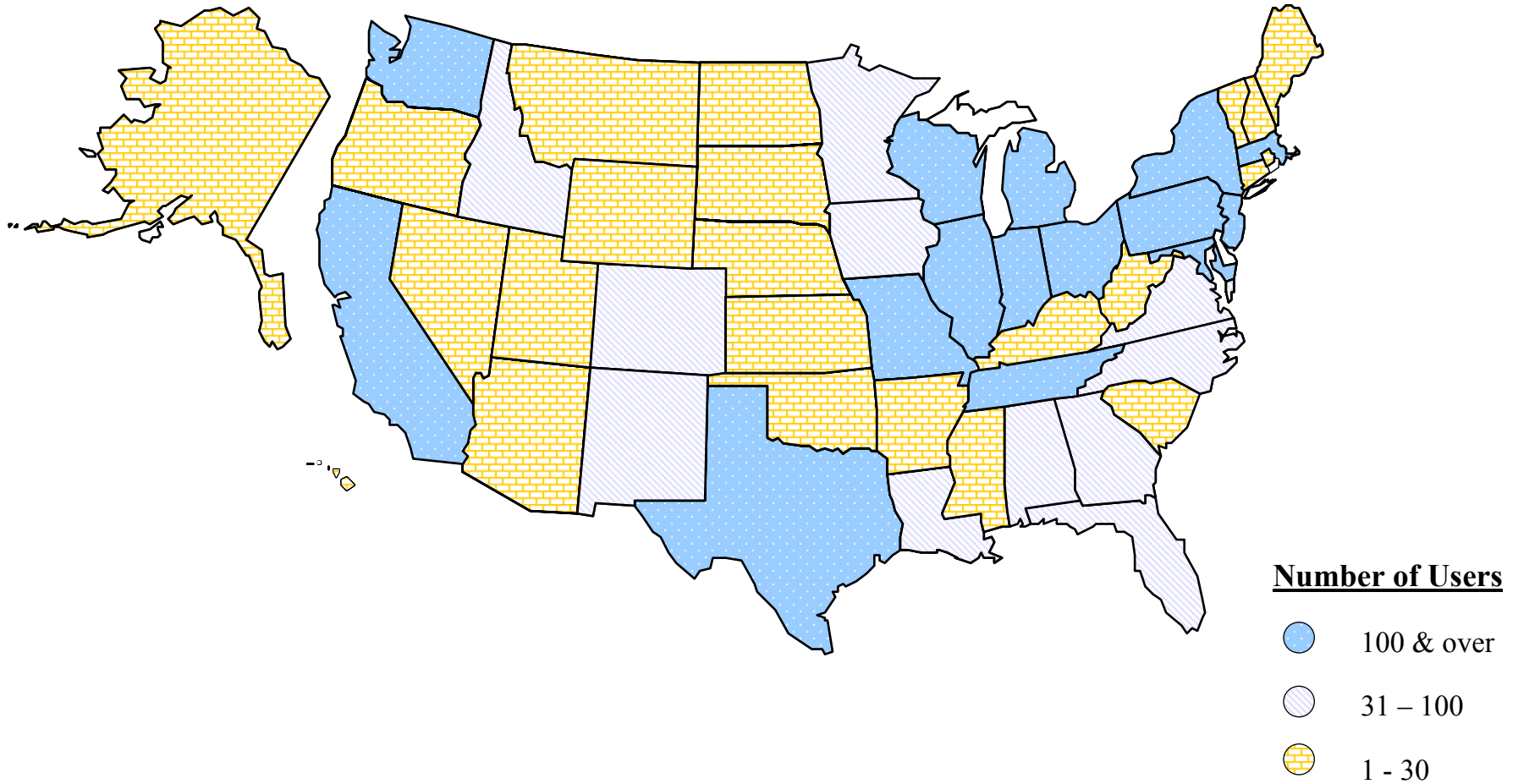
- ❑ Advanced Photon Source (APS)
- ❑ Intense Pulsed Neutron Source (IPNS)
- ❑ Argonne Tandem-Linac Accelerator System (ATLAS)



## ❑ Design, development, and evaluation of advanced nuclear energy systems and proliferation-resistant nuclear fuel-cycle technologies

# About Argonne: where are the collaborators/users?

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# Example #1: what does it take to do structural bio?

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- ❑ “do it” = do it superbly
- ❑ Ingredients
  - ❑ Infrastructure
    - ❑ *Facilities: synchrotron, beam line(s), instrumentation, computing*
    - ❑ *Staff*
  - ❑ Scientists
    - ❑ *Leaders (faculty, senior research staff, ...)*
    - ❑ *Next generation (students, postdocs, ...)*
  - ❑ Support
    - ❑ *Funding*
    - ❑ *“Venue”*

# How does Argonne do this?



## ❑ Plays the organizing role for 3 inter-related activities

### Structural Biology Center (SBC)

- User facility, peer-reviewed access
- Led by A. Joachimiak (ANL)
- Develops instrumentation, software/methods, high throughput technologies
- Supported by DOE/BER and NIH (1 of 9 national sites)
- “Home” for MCSG

### Midwest Center for Structural Genomics (MCSG)

- Consortium of ANL and 6 universities (\*)
- Led by A. Joachimiak (ANL) and 6 university-based co-PI's
- Focus is on developing and optimizing methods for protein structure determination, from expression to modeling
- Supported by NIH/NIGMS

### General Medicine and Cancer Institutes Collaborative Access Team (GM/CA CAT, in progress)

- Builds and operates a national user facility for crystallographic structure determination of biomolecules
- Led by Prof. Janet Smith (Purdue Univ.)
- Supported by NIH Nat. Inst. of Gen. Med. Sciences (NIGMS), National Cancer Institute (NCI) and DOE

(\*) Northwestern Univ., Washington Univ. School of Medicine, University College London, UT Southwestern Medical Center (Dallas), Univ. of Toronto, and Univ. of Virginia

## ❑ ANL leads some activities, universities lead others; in all, ANL plays the role of “glue”, “venue”, and “core of stability”



# The results ...

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- ❑ Success
  - ❑ Structural Biology ANL user community, ANL scientists, and ANL collaborators are the leading depositors of protein structures in the NIH data base
- ❑ The Lab wins
  - ❑ Success breeds success:
    - ❑ *NIH National Institute of General Medical Sciences (NIGMS), National Cancer Institute (NCI) and DOE have funded a new General Medicine and Cancer Institutes Collaborative Access Team (GM/CA CAT)*
  - ❑ Would not have happened if successful Lab/university collaboration had not already been demonstrated
- ❑ The university community wins
  - ❑ Research opportunities have grown explosively
  - ❑ University investments have been appropriate to them
    - ❑ *New faculty hires, growth in student and postdoctoral populations*

# Example #2: how does one lead in software?

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- ❑ “do it” = do it superbly
- ❑ Ingredients
  - ❑ Infrastructure
    - ❑ *Facilities: computing, visualization, networking, ...*
    - ❑ *Staff: world-class programmers with long-term stability*
    - ❑ *Environment:*
      - ❑ Recruiting/defending 1st-rate staff against commercial “raids”/pressures
      - ❑ Building critical-mass, stable software teams
  - ❑ Scientists: the “idea engines”
    - ❑ *Leaders (faculty, senior research staff, ...)*
    - ❑ *Next generation (students, postdocs, ...)*
  - ❑ Support
    - ❑ *Funding*
    - ❑ *“Venue”*

# How does Argonne do this: grid computing

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- ❑ Strategic decision made to define the de facto standard for grid computing



- ❑ Collaboration between

- ❑ *The Distributed Systems Lab (DSL), led by Ian Foster at and UofC*
- ❑ *USC's Information Sciences Institute/Center for Grid Technologies, led by Carl Kesselman*



- ❑ The Lab provided

- ❑ *The necessary critical mass of staff (programmers, systems, ...)*
- ❑ *The physical infrastructure (the “venue”)*
- ❑ *Stability*

- ❑ The universities provided

- ❑ *The faculty leaders*
- ❑ *The students and postdocs*

# The results ...

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- ❑ Globus Toolkit 2.0 has become the de facto standard for grid computing
  - ❑ *MIT Technology Review* named the Grid one of "[Ten Technologies That Will Change the World.](#)"
- ❑ The project is reaping praise
  - ❑ Globus Toolkit 2.0 won the 2002 R&D100 prize
  - ❑ Foster and Kesselman won the British Computer Society (BCS) Lovelace Medal for 2002 (presented by Prof. Sir David King, UK's Chief Scientific Advisor)
  - ❑ ANL's Foster and Tuecke, and USC's Kesselman won the 2003 InfoWorld Top Innovators award
  - ❑ ANL's Foster and Tuecke, and USC's Kesselman won the Federal Laboratory Consortium (FLC) 2003 FLC award for Excellence in Technology Transfer



# What can we conclude?

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- ❑ What did the universities gain?
  - ❑ Access to world-class, constantly updated, facilities and capabilities
  - ❑ Resolution of the classic “support staff” problem
  - ❑ Investments were appropriate to academia
- ❑ What did the Lab gain?
  - ❑ Users and collaborators who
    - ❑ *Did first-rate science*
    - ❑ *Were invested in the facilities, and helped to improve them*
  - ❑ Access to potential first-rate Lab recruits
  - ❑ Crucial help in retaining first-rate scientific leadership
- ❑ What did both gain?
  - ❑ First-rate science
  - ❑ The recognition that goes with doing first-rate science

# What were the crucial do's and don'ts?

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- ❑ What were ANL's "carrots"? What worked?
  - ❑ Don't dominate all activities; let others lead
    - ❑ *Perception must be of collaboration, not exploitation*
  - ❑ Leadership must be visibly first-rate
- ❑ What were the pitfalls for the universities?
  - ❑ The Lab must not be viewed as a servant for university faculty
    - ❑ *Mutual respect on the scientific level is essential*  
(N.b.: The Lab's concurrent obligation is to maintain high standards)
  - ❑ The universities must be seen to put up their share of "risk" capital
  - ❑ Jointly-funded (Univ./ANL) joint appointment help enormously
- ❑ What were the common concerns?
  - ❑ Success is an iterative process
    - ❑ *The initial steps must be modest in order to lower barriers for success*
    - ❑ *Each iteration is more ambitious, and involves a new learning process*
    - ❑ ***... but the ultimate ambition must be large, and shared***

